

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT (PCT Article 36 and Rule 70)

REC'D 03 MAY 2005

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Applicant's or agent's file reference 96 588 a/ubr		FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)	
International application No. PCT/EP 03/04090	International filing date (day/month/year) 17.04.2003	Priority date (day/month/year) 17.04.2003	
International Patent Classification (IPC) or both national classification and IPC H02H3/093			
Applicant ENEL DISTRIBUZIONE S.P.A. et al.			

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

 These annexes consist of a total of 9 sheets.

3. This report contains indications relating to the following items:
 - I ☒ Basis of the opinion
 - II ☐ Priority
 - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
 - IV ☐ Lack of unity of invention
 - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
 - VI ☐ Certain documents cited
 - VII ☐ Certain defects in the international application
 - VIII ☐ Certain observations on the international application

Date of submission of the demand 09.11.2004	Date of completion of this report 02.05.2005
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Kampka, A Telephone No. +49 89 2399-2244 

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. **PCT/EP 03/04090**

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, Pages

1-39 as originally filed

Claims, Numbers

1-26 received on 21.03.2005 with letter of 21.03.2005

Drawings, Sheets

1/11-11/11 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
☐ the language of publication of the international application (under Rule 48.3(b)).
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
☐ filed together with the international application in computer readable form.
☐ furnished subsequently to this Authority in written form.
☐ furnished subsequently to this Authority in computer readable form.
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

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5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).
- (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-26
	No: Claims	
Inventive step (IS)	Yes: Claims	1-26
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-26
	No: Claims	

2. Citations and explanations

see separate sheet

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Re Item V

**Reasoned statement with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement**

Reference is made to the following documents:

D1: EP-A-0 571 898 (ALCATEL STANDARD ELECTRICA) 1 December 1993
(1993-12-01)

D2: US-A-5 710 691 (CUMMINGS DALE D ET AL) 20 January 1998 (1998-01-20)

D3: FR-A-2 751 784 (HITACHI LTD) 30 January 1998 (1998-01-30)

D4: US 2002/101695 A1 (SAKSA THOMAS A) 1 August 2002 (2002-08-01)

1. Independent claim 1 was derived by combining original claims 1 (now preamble) and 15.
2. Document D1 discloses (see column 4, lines 5-23 and 37-41 and column 5, lines 33-40) a device comprising the features of the preamble of claim 1.
3. Starting from D1, the object is to increase the safety level of the circuit breaker.
4. According to claim 1, the object is solved by adding second means for causing the switch to break the electrical current if a current flowing in the electrical circuit exceeds a predetermined rated current for more than a specified duration.
5. None of documents D2 - D4 deals with the problem underlying the present invention and none of documents D2 - D4 give any hint to combine first means for causing the switch to break the electrical circuit in response to a tripping signal generated by processing means depending on a stored programmable current threshold command and a detected current level with second means for causing the switch to break the electrical current if a current flowing in the electrical circuit exceeds a predetermined rated current for more than a specified duration. Therefore, starting from D1, the subject-matter of claim 1 cannot be derived in an obvious way even if the teaching of D2 - D4 is additionally taken into account.
6. Therefore, claim 1 meets the criteria set forth in Art. 33(1) PCT with respect to the

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available prior art. Claims 21 and 23 contain all the features of claim 1, plus additional features, Claims 2 - 20, 22 and 24 - 26 relate to preferred embodiments and therefore also meet these criteria.

Additional remarks:

In order to meet the requirements of Rule 5.1(a)(ii) PCT, D1 should have been cited in the description and the relevant background art disclosed therein should have been briefly discussed.

The definition of the invention in the description should have been adapted to the new claims to be filed to avoid inconsistencies which could lead to unclarity if the claims are read together with the description, Art. 6 PCT. Such inconsistency always arises, if features which were introduced in the independent claim 1 are defined as belonging to preferred embodiments in the description (according to the description, page 4 ,lines 19 - 31 and page 8, line 26 - page 9, line 19 The features of claim 1 only belong to a preferred embodiment), or if features are defined as belonging to the invention, which are not defined in the independent claim. If it is intended to proceed further with the present application in the regional phase before the EPO, the examiner suggests to replace the present "summary of the invention" on page 4, line 19 - page 9, line 30 by the brief statement: "The invention is defined by the features of independent claim 1. Preferred embodiments are defined in the dependent claims."

Int. Appl. PCT/EP 2003/004090
Int. Patent Class. H02H3/0
"Electrical Circuit Breaker"

Our Ref.: 96 588 q1/kun
March 21, 2005

Claims:

1. An electric circuit breaker (1) for protecting an electrical circuit (3) against excessive current loads, comprising
 - a switch (11) to be arranged in said electrical circuit (3);
 - first means (13) for causing said switch (11) to break said electrical circuit (3) in response to a tripping signal (14);
 - means (17) for receiving (IF) and storing (MEM) a programmable current threshold command (CC);
 - means (15) for detecting a current level (CL) in said electrical circuit (3); and
 - processing means (16) for generating said tripping signal (14) depending on said stored programmable current threshold command (CC) and said detected current level (CL);

c h a r a c t e r i z e d b y

- second means (12) for causing said switch (11) to break said electrical circuit (3) if a current flowing in said electrical circuit exceeds a predetermined rated current (I_R) for more than a specified duration (31, 32).

2. The electric circuit breaker (1) according to claim 1, said second means (12) comprising
- a thermal current level detection element; and
 - means for causing said switch (11) to break said electrical circuit (3) if said thermal current level detection element exceeds a temperature threshold.
3. The electric circuit breaker according to any one of the claim 1 or 2, said second means (12) comprising
- electromagnetic current level detection means including a coil; and
 - means for causing said switch (11) to break said electrical circuit (3) if a magnetic force generated by said coil exceeds a threshold.
4. The electric circuit breaker (1) according to claim 1, said second means (12) comprising
- a thermal current level detection means for thermally detecting an amount of current (I) flowing in said electrical circuit;
 - means for causing said switch to break said electrical circuit (3) if said thermal current level detection means exceeds a temperature threshold determining the rated current (I_1) of said electrical circuit breaker (1);
 - electromagnetic current level detection means including a coil for generating a magnetic force in accordance with the amount of current (I) flowing in said electrical circuit (3); and

- means for causing said switch means to break said electrical circuit if said magnetic force generated by said coil exceeds a force threshold (I_2);
- said electromagnetic current detection means and said thermal current level detection means being dimensioned such that an electrical current level (I_2) corresponding to said force threshold is higher than said rated electrical current level (I_1).

5. The electric circuit breaker (1) according to any one of the claims 1 to 4, wherein

- said switch (11) comprises a mechanical interruption element in series with a solid state interruption element;
- said second means (12) for causing said switch to break said electrical circuit if a current (I) flowing in said electrical circuit (3) exceeds a predetermined rated current (I_1) is arranged to trip said mechanical interruption element; and
- said first means (13) for causing said switch to break said electrical circuit in response to a tripping signal (14) is arranged to trip said solid state interruption element.

6. The circuit breaker according to any one of the claims 1 to 5, wherein said first means (13), said second means (12) and said switch (11) are integrated into a single unit.

7. The electric circuit breaker (1) according to anyone of the preceding claims, wherein said means (15) for detecting a current level in said electrical circuit comprises

- means (R) for converting an electrical current flowing in said electrical circuit into a voltage; and

- means (151) for detecting said voltage and outputting a corresponding current level detection signal (CL).

8. The electric circuit breaker (1) according to claim 7, wherein said means (15) for converting an electrical current into a voltage comprises a shunt impedance (R) or an arrangement of coils magnetically coupled to constitute a transformer or a hall effect device or a magnetoresistor or a Rogosky coil.

9. The electric circuit breaker (1) according to any one of the preceding claims, wherein said processing means (16) is adapted to generate said tripping signal (14) after said detected current level (CL) has continuously exceeded said programmed current threshold (I_3 , I_4 , I_5) for a specified duration T_j .

10. The electric circuit breaker (1) according to claim 9, wherein said specified duration can be programmed to depend on the detected level of current (CL) in said electric circuit (3).

11. The electric circuit breaker according to claim 9 or 10, comprising means (17) for receiving and storing a command which specifies said duration T_j .

12. The electric circuit breaker (1) according to claim 10 or 11, comprising

- means for storing a second current threshold (I_1) higher than said programmed current threshold (I_3 , I_4 , I_5);

- said specified duration being a first duration, predetermined or programmed, if said detected current level (CL) is above said programmed current threshold (I_3 , I_4 , I_5) and below said second current threshold (I_1), and a second duration, predetermined or programmed, and shorter than said first duration if said detected current level (CL) is above said second current threshold (I_1).

13. The electric circuit breaker (1) according to claim 12, comprising

- means to receive a second current threshold command;
- said second current threshold storing means being adapted to store said second current threshold in accordance with said received second current threshold command.

14. The electric circuit breaker (1) according to claim 12 or 13, wherein

- said programmable current threshold (I_3 , I_4 , I_5) is lower than said rated current level (I_1); and
- said second current threshold (I_1) is lower than the current level (I_2) corresponding to said force threshold.

15. The electric circuit breaker (1) according to claim 9, wherein said processing means (16) is adapted to

- provide a plurality of functional relations (331, 332, 333) each specifying for a plurality of current levels (I) a respective associated duration (t); and
- select one of said functional relations (331, 332, 333) in accordance with said current threshold command (CC).

16. The electric circuit breaker (1) according to claim 15, wherein said functional relations are stored in said processing means (16) in the form of tables or in the form of software routines for calculating said functional relations.

17. The electric circuit breaker (1) according to any one of the preceding claims, comprising means (17) for receiving a circuit close command; and means (13) for operating said switch (11) to close the electrical circuit in response to said circuit close command.

18. The electric circuit breaker (1) according to any one of the preceding claims, comprising means (17) for receiving a circuit interrupt command; and means (13) for operating said switch (11) to break said electrical circuit (3) in response to said circuit interrupt command.

19. The electric circuit breaker (1) according to any one of the preceding claims, comprising power line communication means (171, IF) for receiving said commands via a public electric power line (LV, 2) which feeds said electric circuit (3) through said switch (11).

20. The circuit breaker according to any one of the preceding claims, wherein

- said first means (13) comprises a coil (131) for electromagnetically driving a movable member (132) and an auxiliary switch (133) connected in series with said coil (131);
- said switch (11) and said auxiliary switch (133) being mechanically coupled with said movable member (132) for actuation thereby;

- a displacement (0133) required for opening said auxiliary switch (133) being larger than a displacement (011) required for opening said switch (11).

21. An electricity meter (100) for measuring the amount of energy supplied to an electricity consumer (Hn) through an electric circuit (3), comprising an electric circuit breaker (1) according to any one of the preceding claims.

22. The electricity meter (100) according to claim 21, comprising

- means (18) for multiplying said detected current level (CL) with a supply voltage (U) of said electrical circuit (3) in order to obtain a measure for the instantaneous active and reactive power levels supplied to said electric circuit (3); and

- means (18) for integrating said obtained instantaneous power levels over time in order to obtain the active and reactive energy supplied to said electrical circuit (3).

23. An electricity distribution network, comprising

- at least one electrical power plant for generating electrical power to be distributed to a plurality of consumers (H1, H2, ..., Hn);
- an electrical power distribution network (HV, MV, LV) for distributing the power generated by said at least one power plant to said consumers (H1, H2, ..., Hn); and
- a plurality of electric circuit breakers (1) according to any one of the claims 1 to 18 and/or a plurality of electricity meters (100) according to claim 21 or 22.

24. The electricity distribution network according to claim 23, comprising administration and control facilities (21) for monitoring load conditions in said power distribution network (HV, MV, LV), and for generating at least one of said commands for said electric circuit breakers (1) in accordance with said monitored load conditions.

25. The electricity distribution network according to claim 24, comprising

- a plurality of primary substations (Tp) arranged between high voltage portions (HV) and medium voltage portions (MV) of said electricity distribution network;
- a plurality of secondary substations (Ts) arranged between medium voltage portions (MV) and low voltage portions (LV) of said electricity distribution network;
- communication means (CBT) arranged at at least one of said secondary substations for receiving commands from said administration and control facilities (21), and for generating said current threshold commands (CC) and/or circuit close commands and/or circuit interrupt commands in accordance with commands received from said administration and control facilities (21);
- power line communication means (24) for injecting said commands generated by said communication means (CBT) into a low voltage portion (LV, 2) of said electricity distribution network for transmission to at least one of said electricity consumers (H1, ..., Hn);
- said administration and control facilities (21) and said communication means (CBT) being arranged to communicate with each other via a public telephone network (20).

26. The electricity distribution network according to claim 25, wherein said public telephone network is a wireless mobile telephone network (20, 23).